What is claimed is:

1. A rheology-modifiable polymeric composition comprising:

(a) a free-radical degradable polymer,

(b) a free-radical inducing species, and

(c) a free radical trapping species having at least two trapping sites,

wherein

(A1) the free radical trapping species (i) substantially suppresses degradation of the polymer in the presence of the free-radical inducing species and (ii) at a trapping site, being graftable onto the polymer after the polymer forms a free radical, and

(A2) the rheology-modifiable polymeric composition yields a rheology-modified polymer being melt processable.

2. The rheology-modifiable polymeric composition of Claim 1 wherein the degradation occurs by chain scission.

3. The rheology-modifiable polymeric composition of Claim 1 wherein the polymer being halogenated and the degradation occurs by dehydrohalogenation.

4. The rheology-modifiable polymeric composition of Claim 1 wherein the resulting rheology-modified polymer being branched.

5. The rheology-modifiable polymeric composition of Claim 4 wherein the branching of the rheology-modified polymer being demonstrable by a Mark-Houwink plot.

6. The rheology-modifiable polymeric composition of Claim 1 wherein the resulting rheology-modified polymer having a gel content as measured by xylene extraction (ASTM 2765) of less than about 10 weight percent.

7. The rheology-modifiable polymeric composition of Claim 1 wherein the resulting rheology-modified polymer having a gel content as measured by xylene extraction (ASTM 2765) of less than about an absolute 5 weight percent greater than the gel content of the base polymer.

8. The rheology-modifiable polymeric composition of Claim 1 wherein the polymer is selected from the group consisting of butyl rubber, polyacrylate rubber, polyisobutene, propylene homopolymers, propylene copolymers, styrene/ butadiene/ styrene block copolymers, styrene/ ethylene/ butadiene/ styrene copolymers, polymers of vinyl aromatic monomers, vinyl chloride polymers, and blends thereof.

9. The rheology-modifiable polymeric composition of Claim 1 wherein the free-radical inducing species being an organic peroxide, Azo free radical initiator, bicumene, oxygen, and air.

10. The rheology-modifiable polymeric composition of Claim 1 wherein the free radical trapping species being a hindered amine-derived free radical trapping species.

11. The rheology-modifiable polymeric composition of Claim 10 wherein the hindered amine-derived free radical trapping species being selected from the group consisting of multi-functional molecules having at least two functional groups of 2,2,6,6,-tetramethyl piperidinyl oxy and derivatives thereof.

12. The rheology-modifiable polymeric composition of Claim 11 wherein the hindered amine-derived free radical trapping species having at least two nitroxyl groups derived from oxo-TEMPO, hydroxy-TEMPO, esters of hydroxy-TEMPO, polymer-bound TEMPO, PROXYL, DOXYL, di-tertiary butyl N oxyl, dimethyl diphenylpyrrolidine-1-oxyl, 4 phosphonoxy TEMPO, or metal complexes with TEMPO.

13. A rheology-modifiable polymeric composition comprising:

(a) a free-radical degradable polymer being capable of forming free radicals when subjected to shear energy, heat or radiation and

(b) a free radical trapping species having at least two trapping sites,

wherein the free radical trapping species (i) substantially suppresses degradation of the polymer when the polymer is subjected to shear energy, heat, or radiation and (ii) at a trapping site, being graftable onto the polymer after the polymer forms a free radical.

14. A rheology-modifiable polymeric composition comprising:

(a) a free-radical degradable polymer and

(b) a free-radical inducing species, and

(c) a free radical trapping species graftable via a free-radical-initiated carbon-FRTS-carbon coupling bond to the polymer,

wherein the resulting rheology-modified polymer having a

$$\text{Maximum Torque} < 1.30 * \text{Minimum Torque}$$

measured by a moving die rheometer at the polymer's coupling temperature, a frequency of 100 cycles per minute, and an arc of 0.5 degrees.

15. A rheology-modifiable polymeric composition comprising:

(a) a free-radical carbon-carbon crosslinkable polymer,

(b) a free-radical inducing species, and

(c) a free radical trapping species having at least two trapping sites,

wherein

(A1) the free radical trapping species (i) substantially suppresses carbon-carbon crosslinking of the polymer in the presence of the free-radical inducing species and (ii) at a trapping site, being graftable onto the first polymer after the first polymer forms a free radical, and

(A2) the rheology-modifiable polymeric composition yields a rheology-modified polymer being melt processable.

16. The rheology-modifiable polymeric composition of Claim 15 wherein the resulting rheology-modified polymer being branched.

17. The rheology-modifiable polymeric composition of Claim 16 wherein the branching of the rheology-modified polymer being demonstrable by a Mark-Houwink plot.

18. The rheology-modifiable polymeric composition of Claim 15 wherein the resulting rheology-modified polymer having a gel content as measured by xylene extraction (ASTM 2765) of less than about 10 weight percent.

19. The rheology-modifiable polymeric composition of Claim 15 wherein the resulting rheology-modified polymer having a gel content as measured by xylene extraction (ASTM 2765) of less than about an absolute 5 weight percent greater than the gel content of the base polymer.

20. The rheology-modifiable polymeric composition of Claim 15 wherein the polymer is selected from the group consisting of acrylonitrile butadiene styrene rubber, chloroprene rubber, chlorosulfonated polyethylene rubber, ethylene/alpha-olefin copolymers, ethylene/diene copolymer, ethylene homopolymers, ethylene/propylene/diene monomers, ethylene/propylene rubbers, ethylene/styrene interpolymers, ethylene/unsaturated ester copolymers, fluoropolymers, halogenated polyethylenes, hydrogenated nitrile butadiene rubber, natural rubber, nitrile rubber, polybutadiene rubber, silicone rubber, styrene/butadiene rubber, styrene/ butadiene/ styrene block copolymers, styrene/ ethylene/ butadiene/ styrene copolymers, and blends thereof.

21. A rheology-modifiable polymeric composition comprising:

(a) a free-radical carbon-carbon crosslinkable polymer being capable of forming free radicals when subjected to shear energy, heat or radiation and

(b) a free radical trapping species having at least two trapping sites,

wherein the free radical trapping species (i) substantially suppresses carbon-carbon crosslinking of the polymer when the polymer is subjected to shear energy, heat, or radiation and (ii) at a trapping site, being graftable onto the polymer after the polymer forms a free radical.

22. A rheology-modifiable polymeric composition comprising:

(a) a free-radical carbon-carbon crosslinkable polymer and

(b) a free-radical inducing species, and

(c) a free radical trapping species graftable via a free-radical-initiated carbon-FRTS-carbon coupling bond to the polymer,

wherein the resulting rheology-modified polymer having a

$$\text{Maximum Torque} < 1.30 * \text{Minimum Torque}$$

measured by a moving die rheometer at the polymer's coupling temperature, a frequency of 100 cycles per minute, and an arc of 0.5 degrees.

23. A rheology-modifiable polymer composition comprising:

(a) a polymer selected from the group consisting of free-radical degradable polymers and free-radical carbon-carbon crosslinkable polymers and

(b) a pendant stable free radical.

24. A rheology-modified polymer comprising a free-radical degradable polymer coupled to a pendant stable free radical.

25. A rheology-modified polymer comprising a free-radical carbon-carbon crosslinkable polymer coupled to a pendant stable free radical.

26. A rheology-modified polymer comprising:

(a) a free-radical degradable polymer and

(b) a free radical trapping species grafted, via a free-radical-initiated carbon-FRTS-carbon coupling bond, to the polymer.

27. A rheology-modified polymer comprising:

(a) a free-radical carbon-carbon crosslinkable polymer and

(b) a free radical trapping species grafted, via a free-radical-initiated carbon-FRTS-carbon coupling bond, to the polymer.

28. A process for preparing a rheology-modified polymer comprising the steps of

(a) preparing a polymer-matrix mixture by admixing

(1) a free-radical degradable polymer,

(2) a free-radical inducing species, and

(3) a free radical trapping species having at least two trapping sites,

wherein the free radical trapping species (i) substantially suppresses degradation of the polymer and (ii) at a trapping site, being graftable onto the polymer after the polymer forms a free radical, and

(b) grafting the free radical trapping species onto the polymer to form a rheology-modified polymer.

29. A process for preparing a rheology-modified polymer comprising the steps of

(a) preparing a polymer-matrix mixture by admixing

(1) a free-radical degradable polymer, and

(2) a free radical trapping species having at least two trapping sites ,

wherein the free radical trapping species (i) substantially suppresses degradation of the polymer and (ii) at a trapping site, being graftable onto the polymer after the polymer forms a free radical,

(b) admixing a free-radical inducing species at a rate sufficient to permit control over the grafting of the free radical trapping species onto the polymer and the resulting molecular architecture of the rheology-modifiable polymer, and

(c) grafting the free radical trapping species onto the polymer after the polymer forms a free radical.

30. A process for preparing a rheology-modified polymer comprising the steps of

(a) preparing a polymer-matrix mixture by admixing

(1) a free-radical carbon-carbon crosslinkable polymer,

(2) a free-radical inducing species, and

(3) a free radical trapping species having at least two trapping sites,

wherein the free radical trapping species (i) substantially suppresses carbon-carbon crosslinking of the polymer and (ii) at a trapping site, being graftable onto the polymer after the polymer forms a free radical, and

(b) grafting the free radical trapping species onto the polymer to form a rheology-modified polymer.

31. A process for preparing a rheology-modified polymer comprising the steps of

(a) preparing a polymer-matrix mixture by admixing

(1) a free-radical carbon-carbon crosslinkable polymer, and

(2) a free radical trapping species having at least two trapping sites ,

wherein the free radical trapping species (i) substantially suppresses carbon-carbon crosslinking of the polymer and (ii) at a trapping site, being graftable onto the polymer after the polymer forms a free radical,

(b) admixing a free-radical inducing species at a rate sufficient to permit control over the grafting of the free radical trapping species onto the polymer and the resulting molecular architecture of the rheology-modifiable polymer, and

(c) grafting the free radical trapping species onto the polymer after the polymer forms a free radical.

32. An article of manufacture prepared from the process of any one of the Claims 28 - 31.

33. An article of manufacture prepared from the process of any one of the Claims 28 - 31, wherein the article prepared being selected from the group consisting of wire-and-cable insulations, wire-and-cable semiconductive articles, wire-and-cable coatings, wire-and-cable jackets, cable accessories, shoe soles, multicomponent shoe soles, weather stripping, gaskets, profiles, durable goods, rigid ultradrawn tape, run flat tire inserts, construction panels, composites, pipes, foams, blown films, and fibers.

34. A foam comprising a rheology-modified propylene copolymer comprising at least 50 weight percent of units derived from propylene, based on the total propylene copolymer material, and units derived from ethylenically unsaturated comonomers and having a melt flow rate in the range of from 0.5 to 8 g/10 min and a melt strength of at least 5 cN.

35. A foam according to claim 34 wherein the foam having a density of 800 kg/m^3 or less.